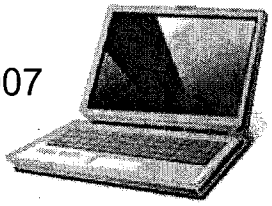
EXHIBIT 1
DATE 2/6/07
HB 5

# Supercomputer Presentation

to

Long-Range Planning Committee

February 6, 2007



## Supercomputer

- A primary duty for the CIO is to implement the conscious policy objectives established by the legislature within the Montana Information Technology Act of 2001

# Supercomputer

- Two of those legislative objectives are:
  - MITA 2-17-512 (a) - the department shall encourage and foster the development of new and innovative information technology within state government.
  - MITA 2-17-512 (c) – the department shall cooperate with the office of economic development to promote economic development initiatives based on information technologies

# Supercomputer

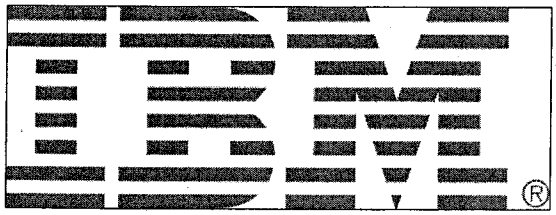
- How does this project meet these two policy objectives to benefit Montana?
  - Information technology is an asset
  - Information technology is the nation's future and the thus is a main component of the future of Montana
  - The states that lead in information technology enjoy a competitive advantage
  - Information technology in America is largely the result of the complex interplay between government, academia, and industry. IT in Montana needs to use the same model to become more competitive
  - The state government role is clear. Industry can only afford to look ahead a few years, but government must invest in the long term. Most of this work occurs nationally at universities and colleges.

# Supercomputer

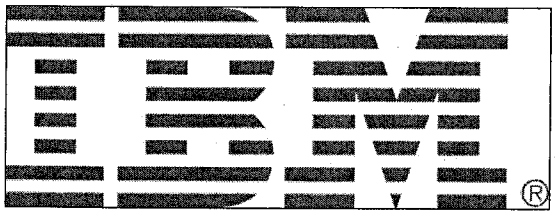
- Inter-agency and private/public coordination – model for success
  - Maximize the likelihood of success in risky endeavors requires multiple agencies – Executive Agencies, Universities, Federal Government and multiple partners and multiple approaches – challenge grant, private/public governance

## Cost Estimate

| | Capital Investment | Recurring Cost |
|---|---|---|
| Supercomputer hardware/software | $5,650,000 | |
| Visualization hardware/software | $1,000,000 | |
| Network Hardware & Monthly Circuit Costs | $100,000 | $45,000 |
| Tape Storage/Printer peripherals | $400,000 | $40,000 |
| Power/Cooling/Security/ Fire suppression | $300,000 | |
| Fixed Cost | $2,350,000 | $200,000 |
| Personnel | | $1,100,000 |
| **Total** | **$9,800,000** | **$1,385,000** |

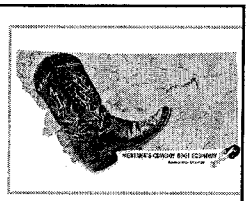




# A Partnership in Progress

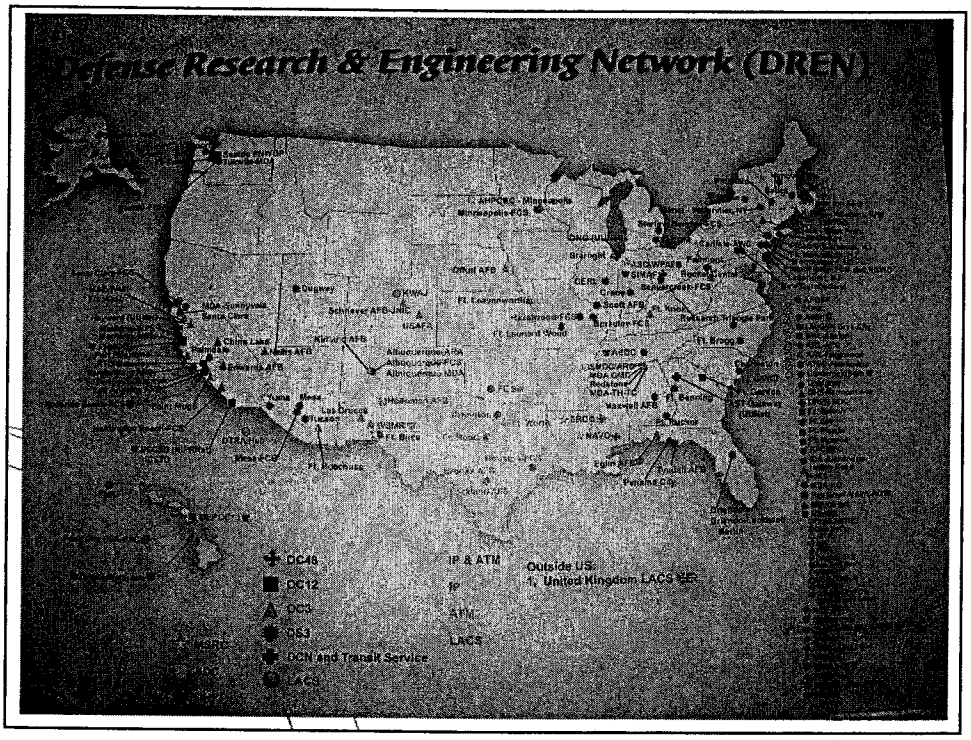

# ECONOMIC COMPETITIVENESS THRU SUPERCOMPUTING

## Montana Supercomputing Center Governor's Vision



- Improve state's technology infrastructure
- Improve state's competitive positioning
- Improve state's economy – inside and outside "the boot"
- Bring opportunities to emerging workforce
- Bring Montanans & Business home
- Promote Public Private Partnerships

# MONTANA IS IN THE CENTER OF A "GREAT AMERICAN DESERT" OF SUPERCOMPUTING & NETWORK INFRASTRUCTURE


Defense Research & Engineering Network (DREN)
OC48
OC12
OC3
DCN and Transit Service
LACS
IP & ATM
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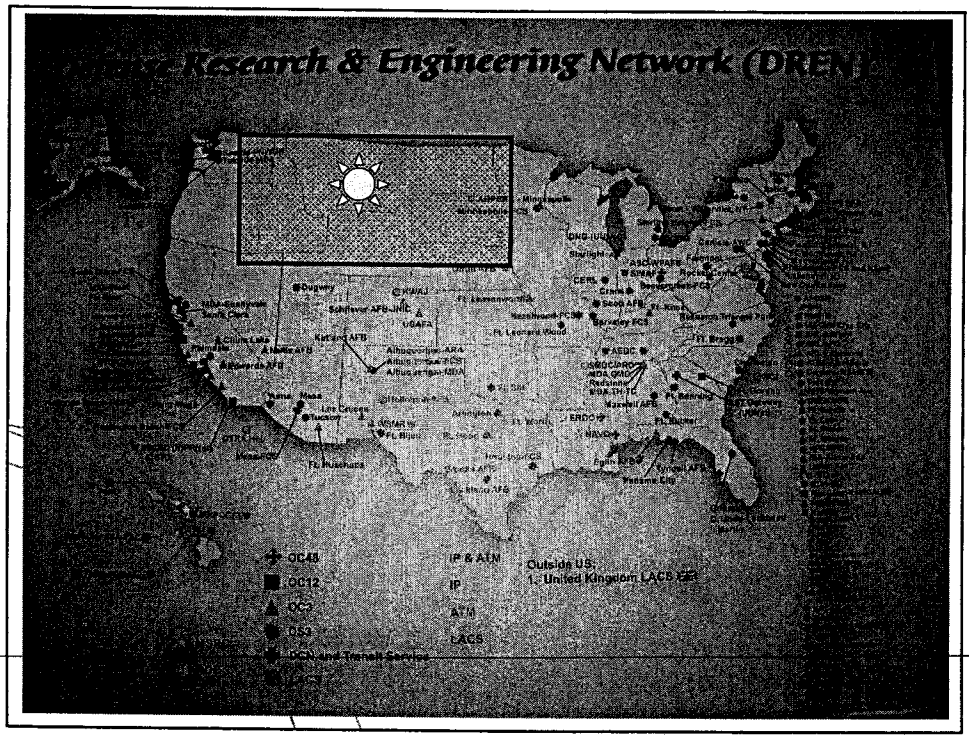
LACS
Outside US:
1. United Kingdom LACS NE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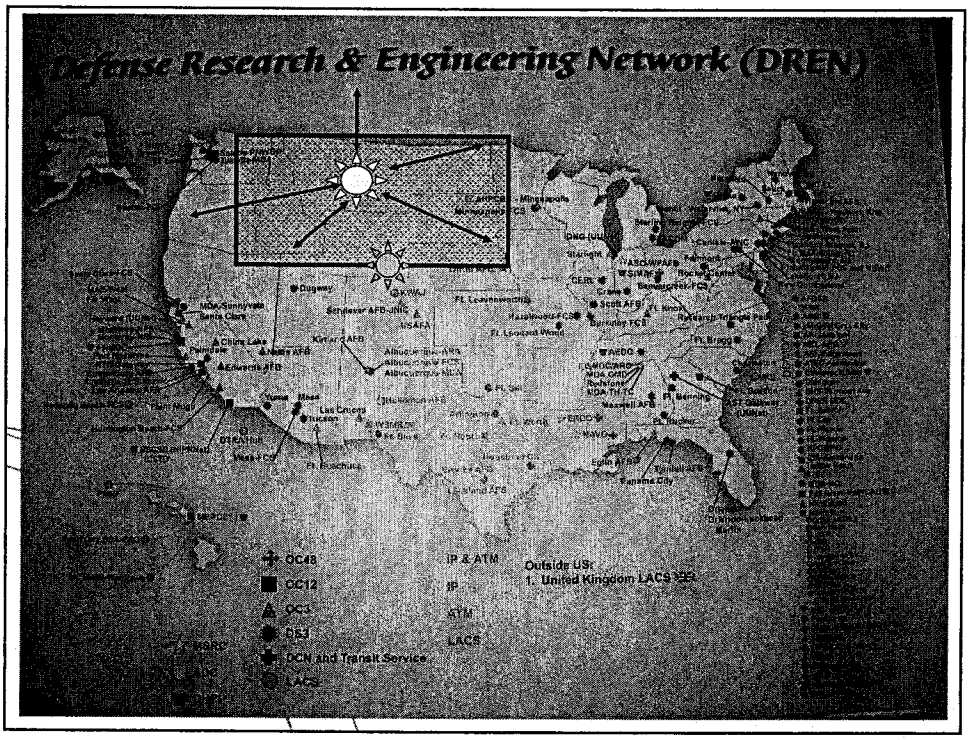
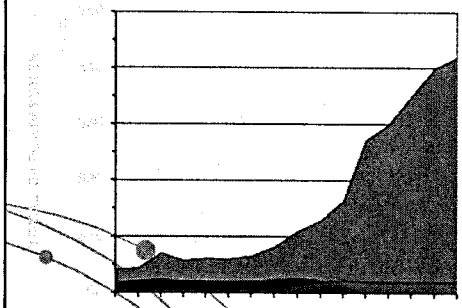



# Growth and Evolution HPC-MS

**Research Expenditures**

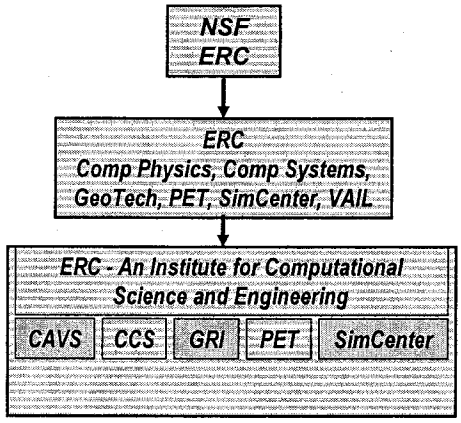
> $260,000,000



**Computational Engineering Program**

> 75 MS graduates

> 25 PhD graduates




**426 Total HPC² Personnel**

| | |
|---|---|
| 55 Academic Faculty | 31 Staff |
| 37 Research Faculty | 114 Graduate Students |
| 15 Postdoctoral | 81 Undergrad Students |
| 93 Research Associates | |

# Growth and Evolution HPC-MS

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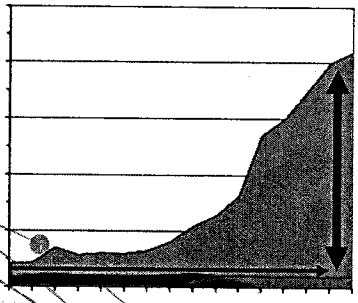

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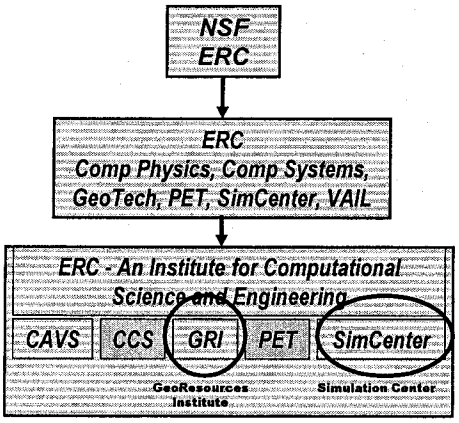


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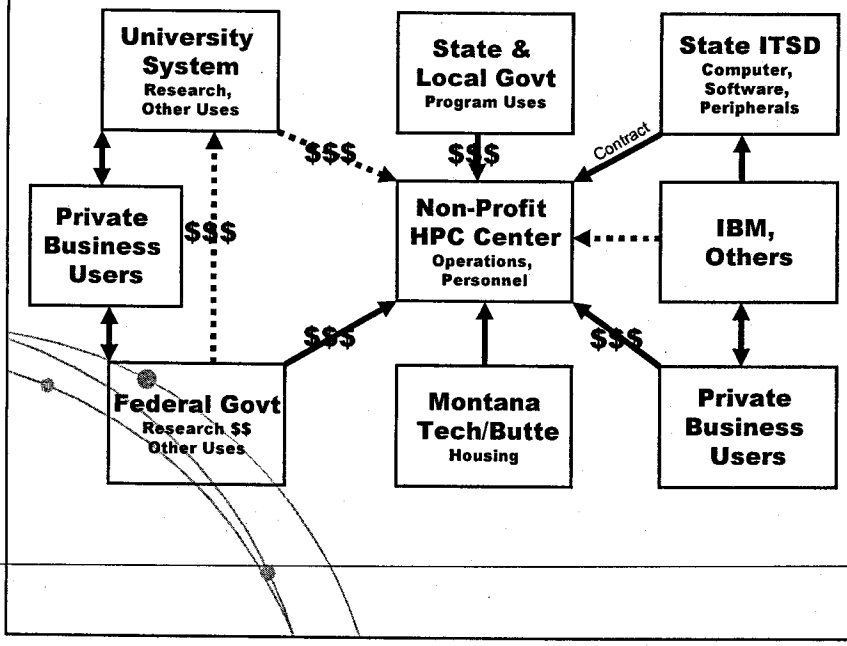
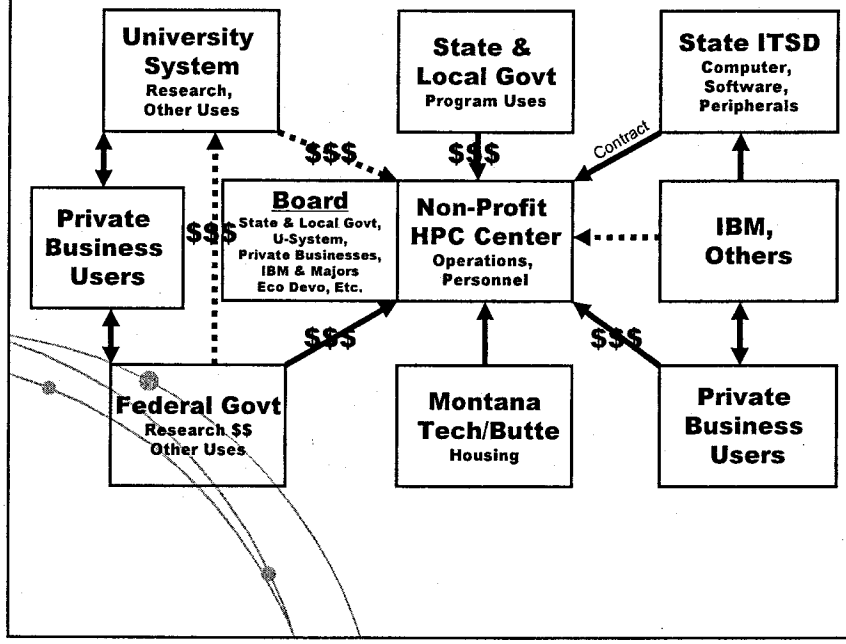
# Montana High Performance Computing Center



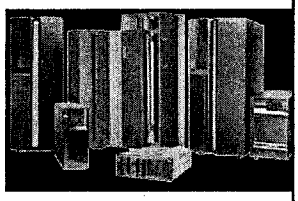
## Montana High Performance Computing Center




IBM

# Montana Supercomputing — Proposal & Testimony

## Powerful Beyond Imagination…



February 2007
Version 4

Earl J. Dodd
IBM Deep Computing

## Executive Summary…

- What do I want from you?
  - Support the IBM proposal and fund the creation a scalable supercomputing infrastructure for the State
- Who's paying for this initial investment?
  - Montana government
  - IBM support + collaborations, research & industry partnerships
- What is the State and Local payback?
  - Secure the State's most precious resource: its People
  - Create the framework for innovation in the 21st Century
  - Create a future-proof revenue base: net new jobs from Industry & Academia



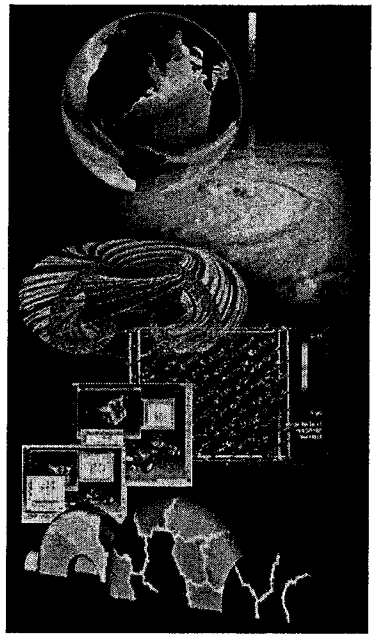


## What are my objectives?

- Tactical
  - Empower Montana to secure a regional prowess in supercomputing and visualization capability to drive research, engineering & industry programs State-wide
- Strategic
  - Use this infrastructure as a framework or blueprint to help Montana attract factors-of-production to build a knowledge-based economy for growth
- Personal
  - Create opportunities so that I can come home

# Agenda

- Introduction
- Why Supercomputing?
- Why IBM?
- Why Now?
- Call to Action…







# Kilo, Mega, Giga, Tera, Peta, and all that…

| Prefix | Symbol | Power of 10 | Power of 2 | Prefix | Symbol | Power of 10 | Power of 2 |
|---|---|---|---|---|---|---|---|
| yocto- | y | -24 * | -- | (none) | -- | 0 | 0 |
| zepto- | z | -21 * | -- | deka- | D | 1 * | -- |
| atto- | a | -18 * | -- | hecto- | h | 2 * | -- |
| femto- | f | -15 * | -- | kilo- | k or K ** | 3 | 10 |
| pico- | p | -12 * | -- | mega- | M | 6 | 20 |
| nano- | n | -9 * | -- | giga- | G | 9 | 30 |
| micro- | u | -6 * | -- | tera- | T | 12 | 40 |
| milli- | m | -3 * | -- | peta- | P | 15 | 50 |
| centi- | c | -2 * | -- | exa- | E | 18 * | 60 |
| deci- | d | -1 * | -- | zetta- | Z | 21 * | 70 |
| | | | | yotta- | Y | 24 * | 80 |

* Not generally used to express data speed
** k = 103 and K = 210

# How fast is a Teraflop?

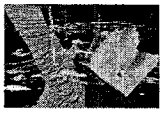
- Teraflop or Teraflops or TFLOP or TFLOPS or TFLOP/s
  - $10^{12}$ (a million million or trillion) floating-point operations per second
- It takes 32,000 years for a trillion seconds to tick away.
- For example, the San Diego Supercomputer Center (SDSC) uses the IBM Blue Gene/L supercomputer with a peak performance of 17.2 TFLOPS. It would take a person operating a hand-held calculator more than 500,000 years to do the calculations this supercomputer completes every second.





# Why supercomputing?

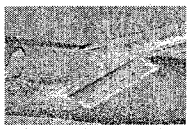
Computational Needs of Technical, Scientific, Digital Media & Business Applications Approach or Exceed the Petaflop/s Range



**M-OSRP Seismic**
**45 x 10e15 FLOPS**

Source: AGM, LGC, M-OSRP

**Intelligent Oilfield**
**1.7 x 10e21 FLOPS**



Source: A. Jameson, et al

**CFD Wing Simulation**
**2.1 x 10e14 FLOPS**

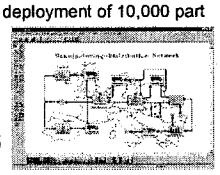
**CFD Full Plane Simulation**
**8.7 x 10e24 FLOPS**

**Digital Movies & Special Effects**
**2.7 x 10e19 FLOPS**

Source: Pixar

Modeling the optimized deployment of 10,000 part

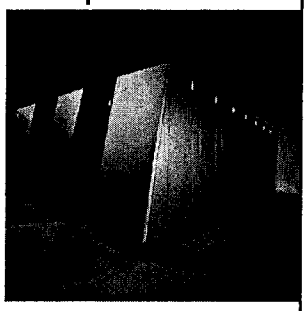
**Spare Parts Inventory Planning**
**2.4 x 10e15 FLOPS**



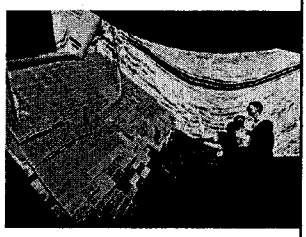
Source: B. Dietrich, IBM

# IBM means supercomputing leadership

- ✓Leads the list with world's #1 supercomputer (DoE/NNSA/LLNL 280.6 TFLOPS)
- ✓And #3 BlueGene/W at Watson Research
- ✓And #4 ASC Purple at LLNL
- ✓And #5 MareNostrum JS21 at Barcelona Supercomputing Center
- ✓Leads list with 237 entries (47.4%)
- ✓Leads installed aggregate throughput with over 1,750 out of 3,527 Teraflops (49.6%)
- ✓Most systems in TOP10 by any single vendor (4)
- ✓Most systems in TOP20 with 6 systems (30%)
- ✓Most systems in TOP100 systems with 44 (44%)
- ✓Most Cluster systems with 171 of 361 (47.3%)
- ✓Fastest system in USA (LLNL)
- ✓Fastest system in Europe (Barcelona).



http://www.top500.org/

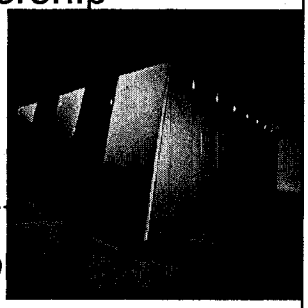


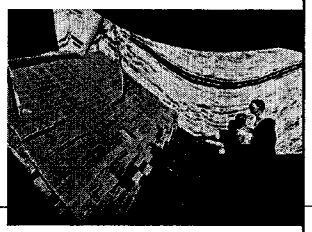




# IBM means supercomputing leadership

- ✓#1 supercomputer in the world
  - ✓And #3, #4, #5
- ✓Leads the list with 237 entries
- ✓Leads installed aggregate throughpu
- ✓Most systems in TOP10, TOP20, TO
- ✓Most Cluster systems
- ✓Fastest system in USA
- ✓Fastest system in Europe
- ✓Fastest system in Academia.





## Why IBM and Why Now?

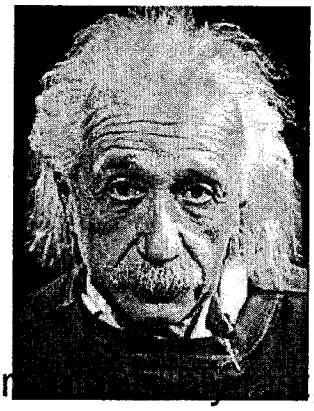
- IBM is the world leader in supercomputing & distributed visualization
- IBM has done this before with Governments:
  - WAG (WDA), IDA, Ontario
- IBM has name & brand recognition, financially & organizationally secure
- IBM is willing to advance this ecosystem & the corresponding business & industry partnerships
- IBM sees a way to increase its sales & profitability due to long-term business opportunities
- And more…





## Call to Action!

- Support the Supercomputing Proposal
- Fund & execute this Proposal
- Finalize the logistics & facilities plan
- Procure & install the Supercomputing resources
- Launch the facility (& leverage IBM's media engine)



"Computers ar , accurate and stupid. Human beings are incredibly slow, inaccurate, and brilliant. Together they are powerful beyond imagination."

- Albert Einstein





## Thank You!

Earl J. Dodd
Strategist
Deep Computing

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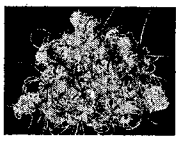
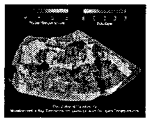
http://www.ibm.com/servers/deepcomputing/

## Questions?

# Backup Information…



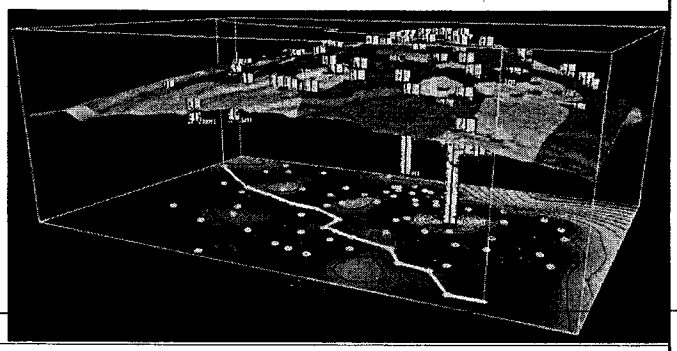




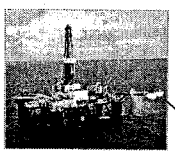



# IBM initiatives in the "Energy & Environment" theme

- **Intelligent Oilfield & Intelligent Plan**
- **Alberta Oil Sands Centre of Excellence (CoE)**
- **Global Innovation Outlook (GIO)**
- **M-OSRP**
- **RPSEA**



# Intelligent Oilfield (IOF)



Remote sensors collect well and field data. "Learning algorithms" detect serious problems/events like sanding in advance.

Field technicians are alerted in advance of production problems. Field tickets are developed directly in maintenance systems

Remote operations control rooms react to event alarms, alert field technicians, analyze historical data and real-time data, and collaborate with value-chain partners.

Near real-time data is sent to seismic and economic evaluation tools for better reservoir management.

SAP maximo

Field tickets are input directly into, and data is accessed directly from, ERP systems

Partners

Value chain partners are consulted with real-time access to control room data.

IBM's Intelligent Oilfield helps E&P companies increase reserves replacement and reduce costs.





# Oil Sands Centre of Excellence

Calgary, Alberta – June 27, 2006 **– IBM is investing $1.4 million in 2006 to establish the IBM Oil Sands Centre of Excellence to address the business challenges of efficiently extracting petroleum from Alberta's oil sands.**

**Located in Calgary, the Centre will help reduce operational risks associated with oil sands projects by developing industry-specific business and technology solutions. These solutions will improve the efficiency of many aspects of oil sands development projects, from construction and project management, to labour productivity, process optimization and environmental management.**

**Oil sands projects require the construction of some of the largest open pit mines and industrial processing facilities in the world, and significant investment in people and resources is necessary. Construction project risks and operational costs are much higher than in conventional oil exploration, and oil sands projects can benefit greatly from the effective use of advances in information technology.**

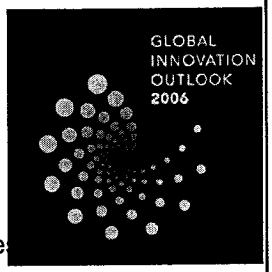
**"Extracting and refining oil from the oil sands is a knowledge and technology intensive process," said Victor Doerksen, Alberta Minister of Innovation and Science. "New investments that support the application of technology in the oil sands are important in ensuring long-term industry success."**
**IBM works closely with a number of companies involved in oil sands projects and plans to partner with other technology companies and key industry players at the Centre.**

**"The opportunity and challenges presented by Alberta's oil sands are enormous – $70-billion in investment over the next two years alone – and industry partnerships will be key to unlocking this potential," said Graeme Bate, a partner with IBM Canada's chemical and petroleum industry. "We're inviting oil sands companies and industry stakeholders to work with us at the Centre to create new and innovative solutions for this burgeoning industry."**

**As global energy requirements continue to climb, the Alberta oil sands are an important part of North America's energy supplies, and the Centre will help improve the financial and operational efficiency of the industry.**

About IBM **To learn more about IBM's solutions for the petroleum industry, visit: http://www-03.ibm.com/industries/ca/en/chemicalspetroleum/petroweb/**

# IBM's Global Innovation Outlook




The changing nature of innovation related to…

- Environment and Eco-efficient Technologies
  - Focus areas include eco-efficient technologies; economic impact of access to clean water supplies; predictive environmental impact services
- Transportation and Mobility
  - Focus areas include mega-urban centers and smart traffic management; "connected" vehicles; customs, ports and border control
- The Future of the Enterprise
  - Focus areas include designing the 21st century corporation; managing global talent and skills; alternate R&D/innovation models; the "global" small business



# M-OSRP

Mission - Oriented Seismic Research Program

- **M-OSRP is a research and educational consortium supported by all the major publicly traded petroleum companies worldwide, 4 national oil companies and several large service companies**
- **The research objectives are to address outstanding fundamental technical problems whose solutions would have the biggest positive impact on our ability to locate and produce hydrocarbons**
- **A key technical objective is removing multiples and imaging and inverting primaries in depth, in complex media, without knowing or determining subsurface properties.**
- **While removing the traditional need for subsurface information, these fundamentally new methods require a *new computational vision and capability.***

**Fig 1: Free surface multiples elimination**

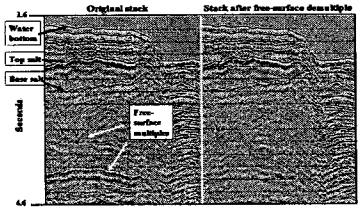
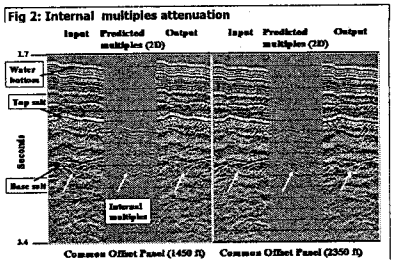



**Fig 2: Internal multiples attenuation**

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# U.S. Department of Energy Advancing Supercomputing Technology with IBM Partnership

Nov 15, 2006 *News Release*

The U.S. Department of Energy (DOE) announced today that its Office of Science, the National Nuclear Security Administration (NNSA) and IBM will share the cost of a five-year, $58 million research and development (R&D) effort to further enhance the capabilities of the fastest computer in existence. Under the agreement, scientists from two of the DOE's national laboratories are teaming with IBM to further develop supercomputer technology to increase America's ability to deliver answers to scientific problems and to safeguard the nation's nuclear stockpile.

"Supercomputing is essential to maintaining and extending America's economic competitiveness," said DOE Secretary Samuel Bodman. "This R&D effort will give us the capability to advance science and business with unprecedented speed, performance and efficiency."

A key goal of the R&D effort is to produce a software environment that enables scientific exploration atop an architecture that can scale to hundreds of thousands of low-power CPU cores. Some other specific examples of scientific problems in the national interest include:

- reinvigorating nuclear power technologies;
- speeding genome sequencing;
- modeling environmental and climate changes; and
- deepening the understanding of genetic and biological processes.

The work will be performed by scientists at DOE's Argonne National Laboratory (ANL) and Lawrence Livermore National Laboratory (LLNL) working together with computer and software designers from IBM. NNSA and The Office of Science will each contribute $17.5 million and IBM will contribute $23 million.

"Supercomputers are crucial to the continued success of the NNSA's science-based efforts to keep the U.S. nuclear weapons stockpile safe, secure and reliable without underground testing," said NNSA Administrator Linton F. Brooks. "Computing at these scales will enable predictive simulations that allow researchers to understand how complex physical, chemical and biological systems behave over time. Previously, it was only possible to get brief snapshots on a smaller scale."

"This agreement will help us design computer architectures to attack key scientific problems," said Dr. Raymond L. Orbach, DOE Under Secretary for Science. "It offers a tremendous step forward."





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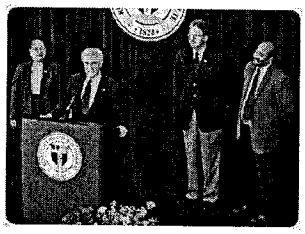
## Rensselaer, IBM, State Join in $100 Million Partnership To Create World's Most Powerful University-Based Computing Center



Pictured are (l-r) President Shirley Ann Jackson, Majority Leader Joseph L. Bruno, John E. Kelly III, IBM's senior vice president of technology and intellectual property, and Omkaram (Om) Nalamasu, vice president for research at Rensselaer. Photo by RPI/Polytechnic

http://news.rpi.edu/

# The Value of the Montana SuperComputer Center for Advanced GIS Analysis

Economic Value to the Montana GIS Community –

A Private Sector Perspective

## SuperComputer Center Value

- Ability to pursue government and commercial contracts that are currently unattainable without SuperComputer Center
- Ability to deliver and expand existing contract work and tackle next-generation problems associated with government related research projects and programs.
- Overall competitiveness as a Montana-based company to achieve goals and objectives

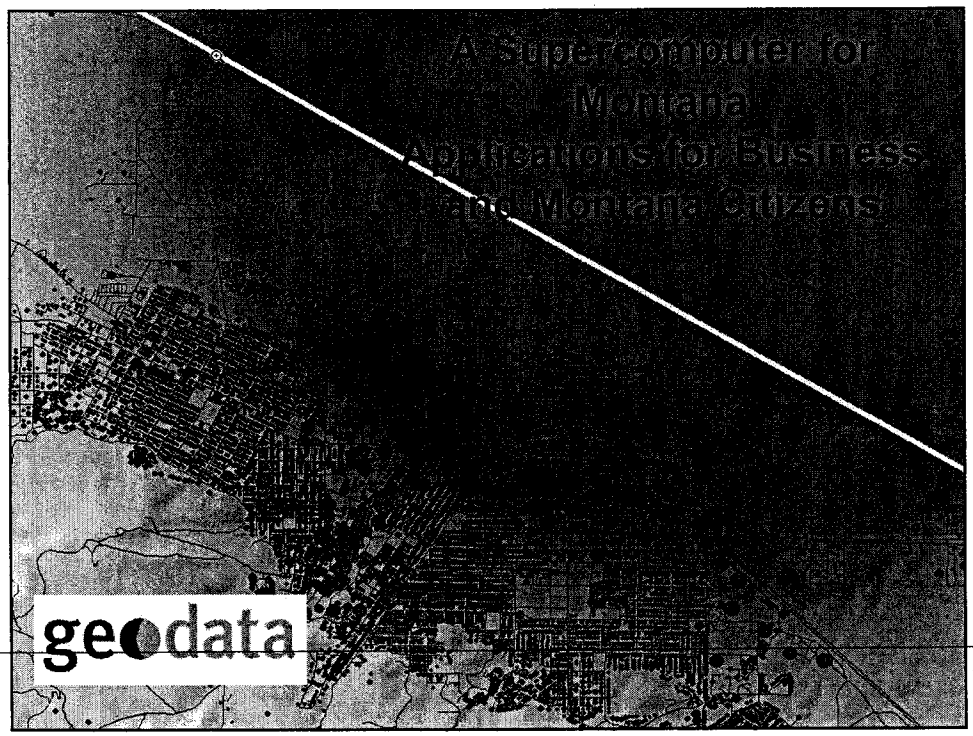
## GIS Program for SuperComputer Utilization

- Advanced modeling and simulation for impacts on human populations from chem/biological, and radiological events
  - Department of Homeland Security
  - DARPA
- Massive parallelism for modeling smart data advanced for next-generation network centric information systems
  - US Army, US Navy, NASA
- Management of Digital Acoustic Signal and Classification Algorithm
  - US Navy – Naval Undersea Warfare Center

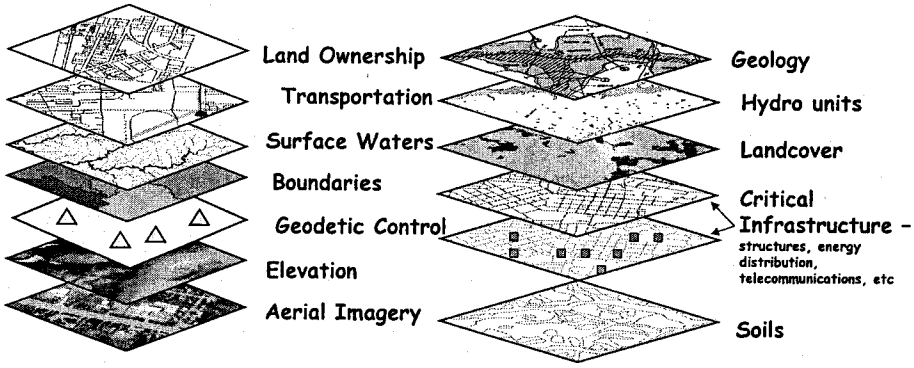
- "Synthetic Montana" – Advanced comprehensive model of all economic sector and associated critical infrastructure for economic development patterns and simulations based upon changing demographics and population dynamics
  - National Science Foundation, Gov. Office of Economic Development
- Sensor Modeling – Sensor Fusion project for combining and analysizing real-time sensor data from a variety of platforms for analysis of geospatial component(s)
  - DOE – Idaho National Laboratory, Critical Infrastructure Protection Center for Excellence

## Contact

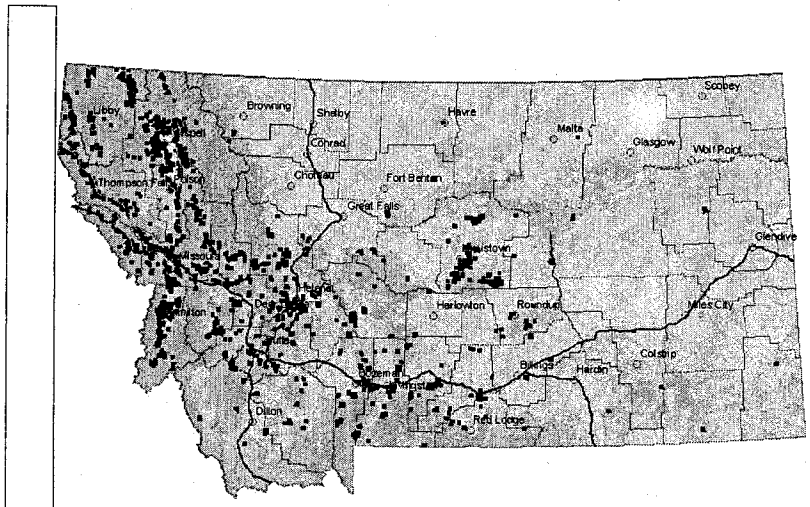

- Dr. Alex Philp
  President, GCS Research LLC
  1121 East Broadway, Suite 113
  Missoula, MT 59802
  406-532-3254
  406-532-3255 (Fax)
  www.gcs-research.com

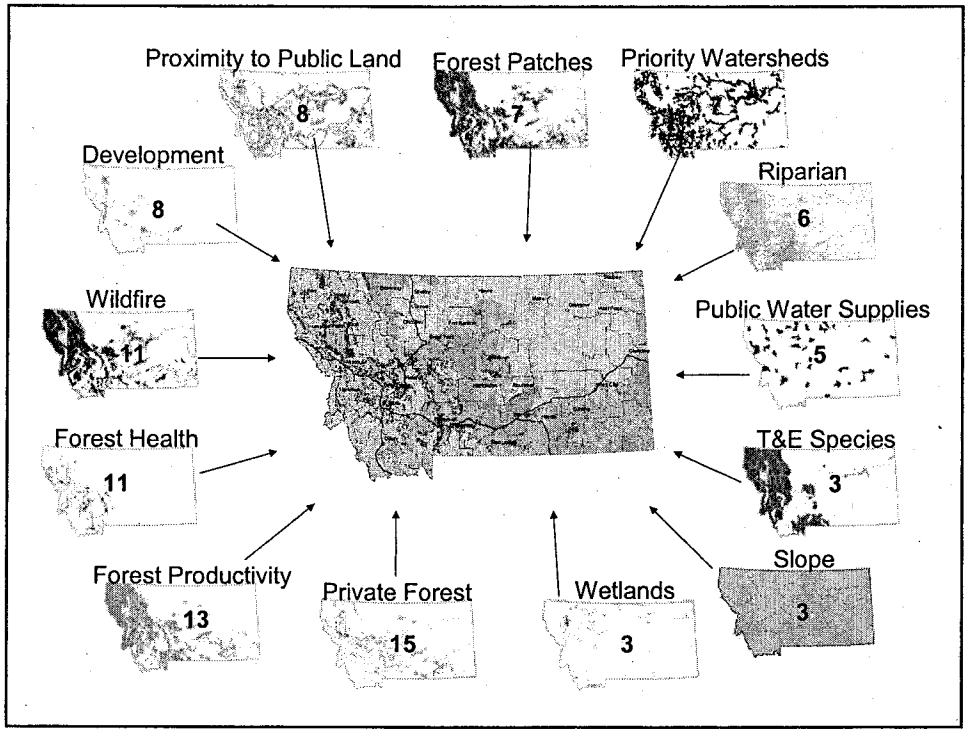



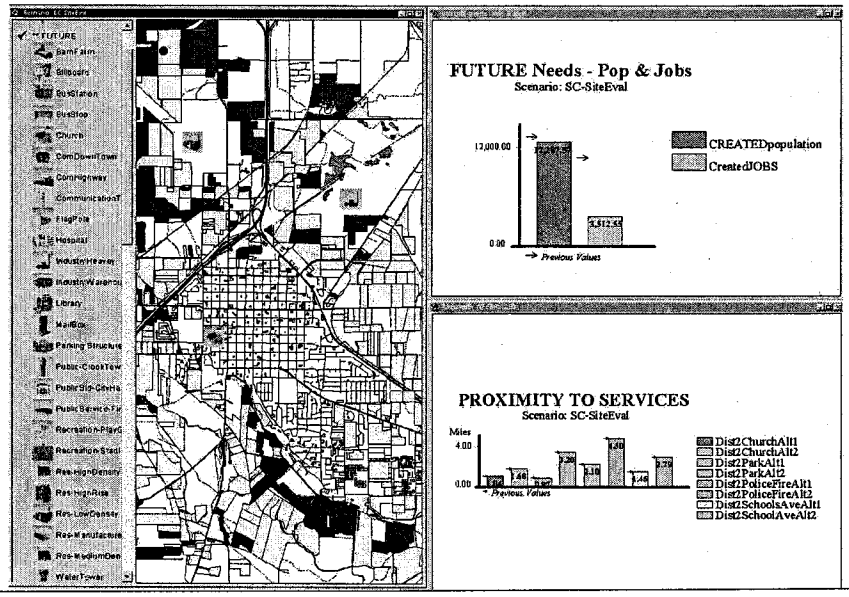
# GIS is about Layers



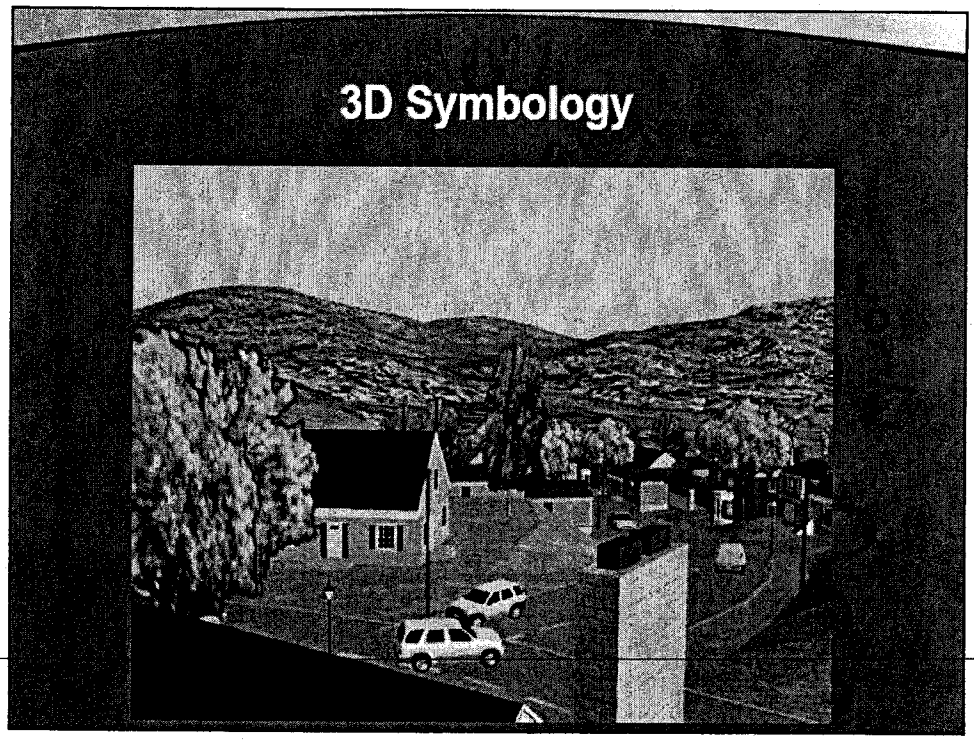

# Map of Existing Stewardship Plans




Proximity to Public Land
8
Forest Patches
7
Priority Watersheds
Development
8
Riparian
6
Wildfire
11
Public Water Supplies
5
Forest Health
11
T&E Species
3
Slope
3
Forest Productivity
13
Private Forest
15
Wetlands
3


FUTURE Needs - Pop & Jobs
Scenario: SC-SiteEval
12,000.00
0.00
CREATEDpopulation
CreatedJOBS
Previous Values
PROXIMITY TO SERVICES
Scenario: SC-SiteEval
Miles
4.00
0.00
Previous Values
Dist2ChurchAlt1
Dist2ChurchAlt2
Dist2ParkAlt1
Dist2ParkAlt2
Dist2PoliceFireAlt1
Dist2PoliceFireAlt2
Dist2SchoolsAveAlt1
Dist2SchoolAveAlt2

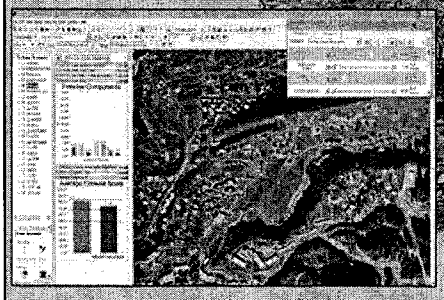
## GIS - Business and Economic Development

**The desktop computer examples I've shown are small areas the size of the tip of the pin below in the Helena example– The Supercomputer will allow us to model larger, more complex models, covering the entire state and multiple time periods**

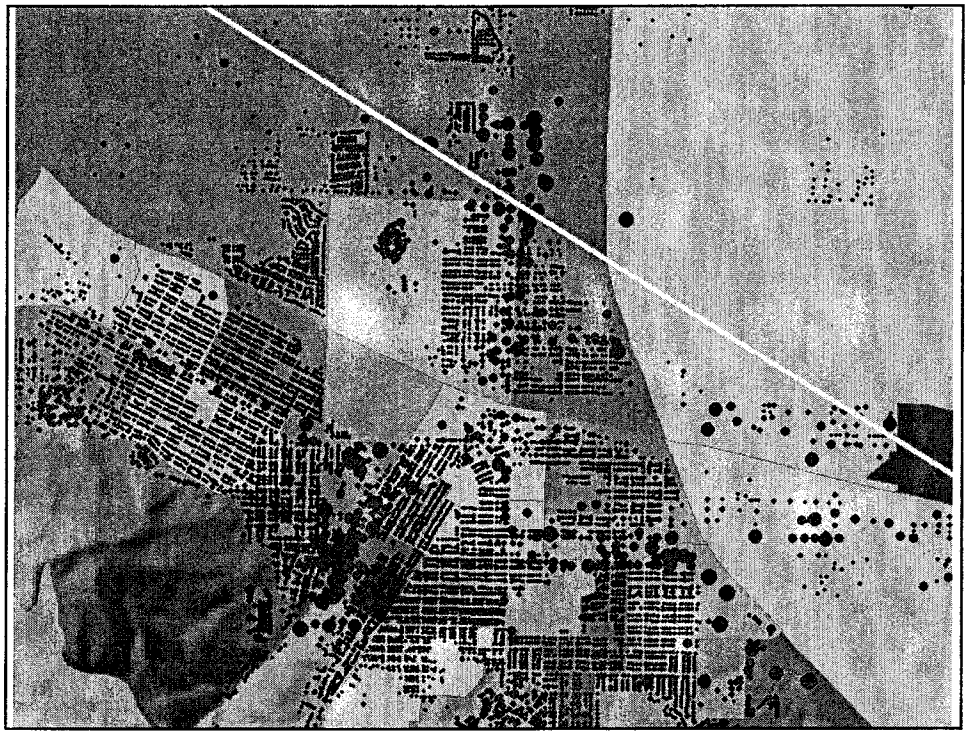

# Example: Assessing Wildfire Risk

**CommunityViz Firewise Scenario Planner**





**ArcIMS Homeowner Firewise Calculator**



# GIS and the Lewis & Clark Earthquake Exercise 2006

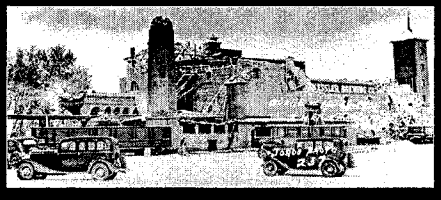


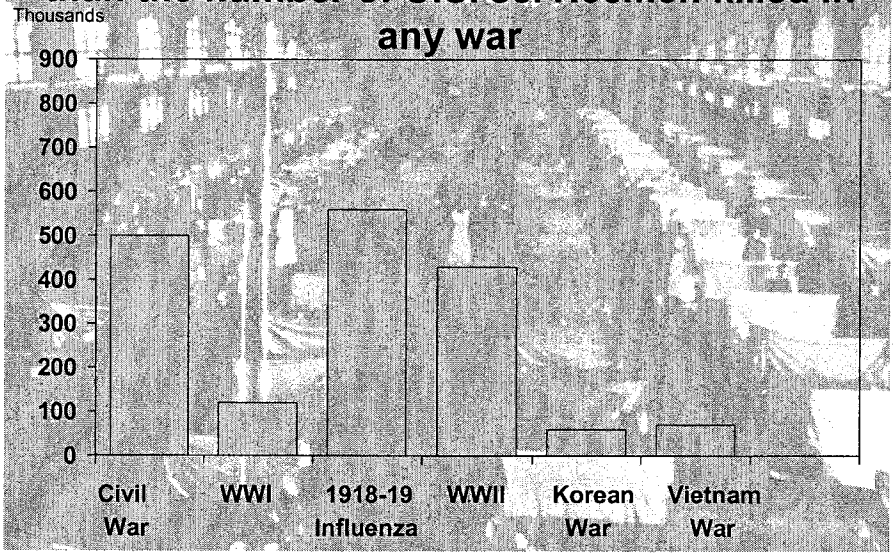
Photo by L.H. Jorud, Helena, MT;
from MT Historical Society collection
Courtesy of Alison James,
Canyon Ferry Limnological Institute

Photo published by MT Bureau of Mines
and Geology in "Memoir 16, The Montana
Earthquakes of 1935," by Harold W. Scott
Courtesy of MT Bureau of Mines and Geology

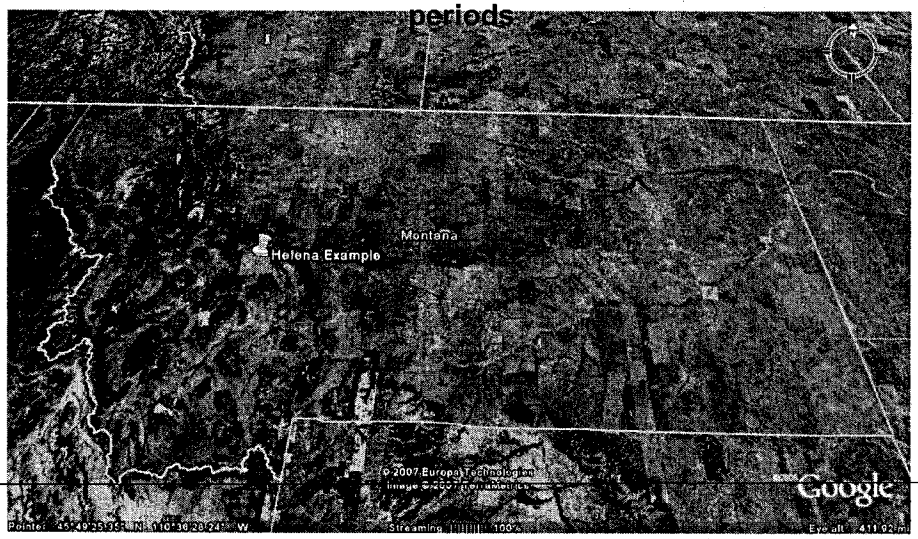
***How can GIS help responders in a disaster such as the 6.25 magnitude earthquake that hit Helena on October 18, 1935?***

# Pandemic Flu

## America's deaths from influenza were greater than the number of U.S. servicemen killed in any war

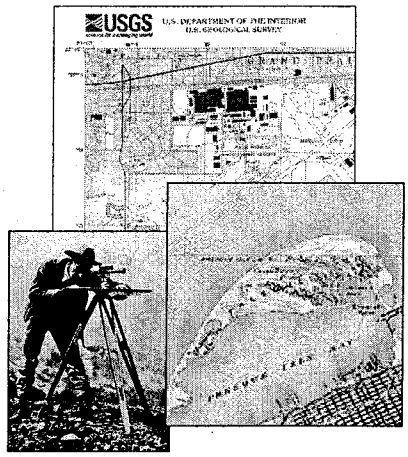



**The desktop computer examples I've shown are small areas the size of the tip of the pin below in the Helena example– The Supercomputer will allow us to model larger, more complex models, covering the entire state and multiple time periods**



USGS
science for a changing world

# United States Geological Survey



Lance Clampitt
USGS Geospatial Liaison for Montana
February 6, 2007

U.S. Department of the Interior
U.S. Geological Survey


USGS U.S. Geological Survey

National Park Service

Bureau of Land Management

U.S. Fish and Wildlife Service

Bureau of Reclamation

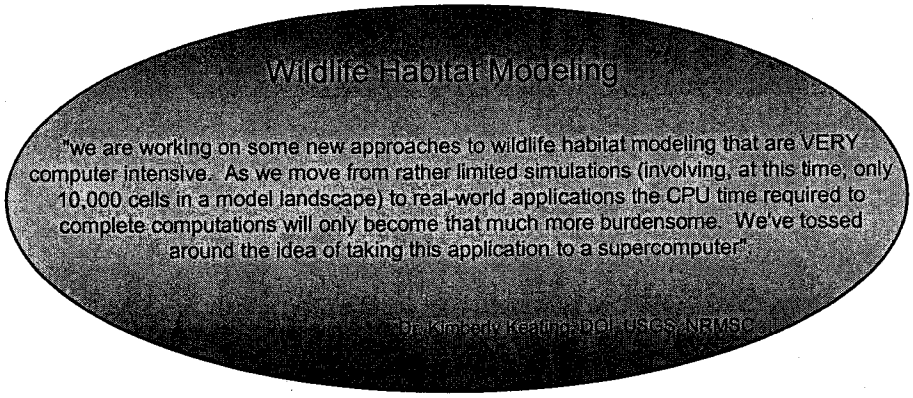
Bureau of Indian Affairs

MMS Minerals Management Service

Office of Surface Mining

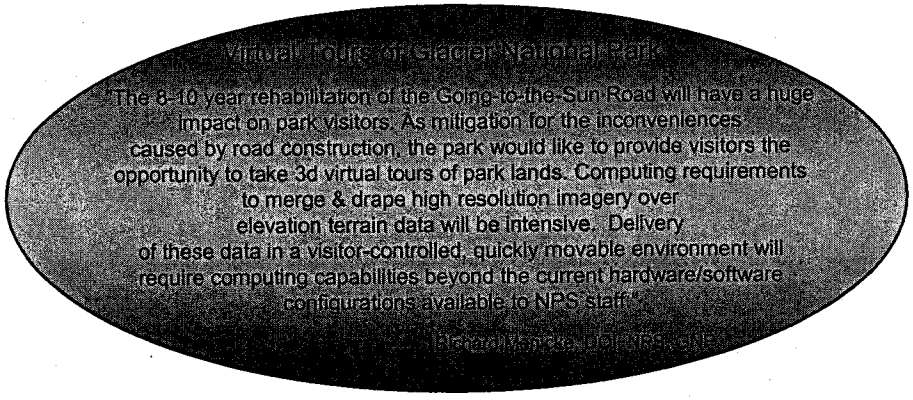
USGS

## Potential Federal Use of a Regional "Deep Computing" Resource



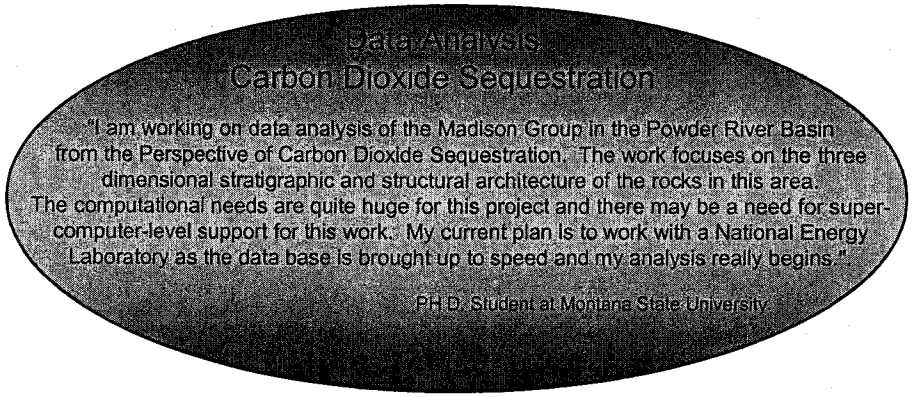

USGS

## Potential Federal Use of a Regional "Deep Computing" Resource




USGS

**Potential Federal Use of a Regional "Deep Computing" Resource**




USGS

# Super-Computing-Montana (SC-MT)

Dr. David Hobbs
Dr. Richard Donovan
Montana Tech
February 6, 2007

# SC-MT Application Areas

- Aerospace
- Natural Resources
- Defense and Homeland Security
- Education and Technical Outreach

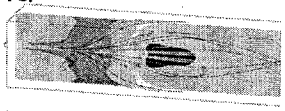
# A model for Successful Super-Computing-Mississippi State (SC-MS)

*Computational Simulation & Design Center (SimCenter)*


- Primary customers include:
  - DoD
  - NASA
  - NSF
  - Bell Helicoper
  - Boeing
  - Northrup Grumman
  - P&W-Rocketdyne
- Annual Funding = 5.6M
  - (80% federal, 20% industrial)

# Impact-Aerospace Industry

- Aerospace
  - Computational Fluid Dynamics (CFD)
  - Advanced Materials (Alloys, composites, nano-)
  - Materials Simulation and Testing
  - Precision Fabrication



- Montana Impact
  - MSE TA (hypersonic flight research)
  - Summit Aeronautics (aerospace manufacturing)
  - MUS Aerospace Engineering Education

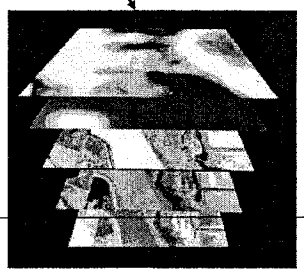
# Mississippi State (SC-MS) Centers

*SimCenter*

*GeoResources Institute (GRI)*

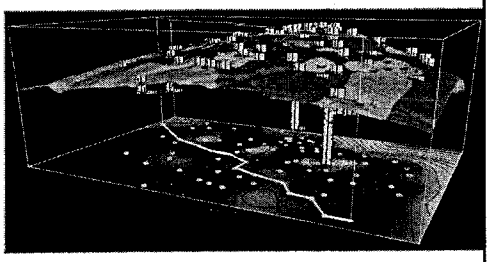
**GRI Vision**

To be a world leader in advancing the state-of-the-art in spatial technologies and resource management.



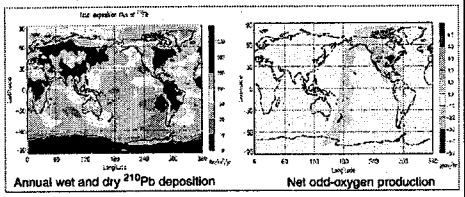
# Impact-Natural Resources

- Energy Exploration and GIS
  - Characterization of oil, coal and coal-bed methane reservoirs
  - Clean Coal processes
    - carbon sequestration
  - Ground Water modeling



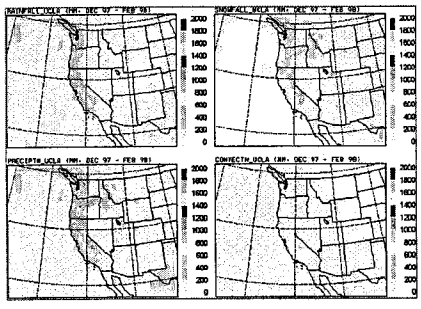
# Impact-Natural Resources

- Wind Energy
  - Wind/weather Modeling
  - High-resolution Forecasting
- Agriculture (remote sensing & visualization)
  - Fire Forecast and logistics
  - Invasive Species
  - Drought Management



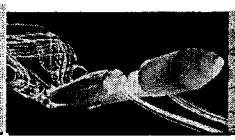
Annual wet and dry $^{210}Pb$ deposition

Net odd-oxygen production



Weather Modeling

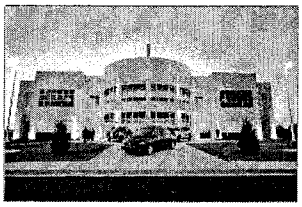
# Mississippi State (SC-MS) Economic Development



*Center for Advanced Vehicular Systems (CAVS)*

*SimCenter*

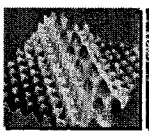
*GRI*



*Nissan*
Canton, MS

- Hybrid vehicles
- Power electronics
- Manufacturing simulations
- Particulate materials
- Human Factors – biomechanics
- Cyber-infrastructure
- Advanced learning technologies

# Mississippi State (SC-MS) and DOD



*CAVS*

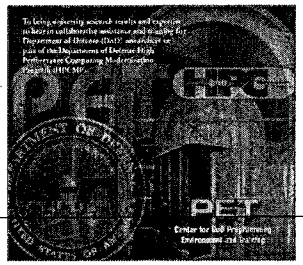
*Center for Computational Sciences (**CCS**)*

*SimCenter*

*GRI*

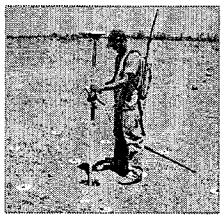
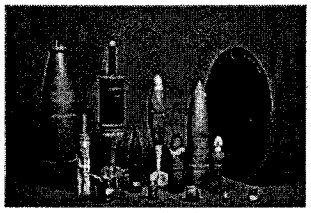
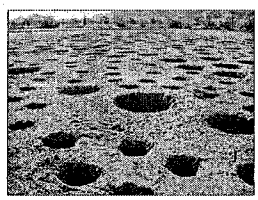
*Center for **DoD** Programming Environment & Training (**PET**)*

- Predator EM vulnerability: 15,000 design analyses
  - 12 months – 2 months
- Submarine structural analyses
  - 10x time reduction
- Tank EM
  - 2x speedup



# Impact-Defense and Security

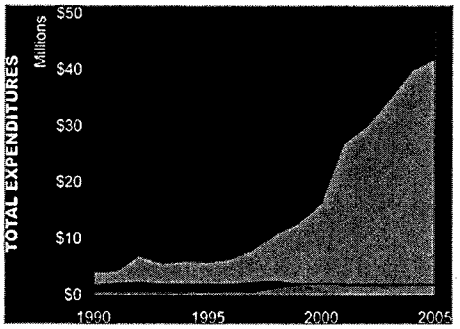
- Unexploded Ordinance (UXO)
  - $500M potential liability
  - Largest settled lawsuits statewide
  - Long-term Investment consequences

# Impact-Program for SC-MT

- DoD-HPCMP, DoD EPSCoR (UXO)
- NSF-ERC (Aerospace)
- NSF-PFI (Statewide innovation network)
- ??

# Growth and Evolution SC-MS




Research Expenditures

> $260,000,000

Computational Engineering Program development

> 75 MS graduates
> 25 PhD graduates

Current HPC Personnel

| | | | |
|---|---|---|---|
| Academic Faculty | 55 | Research Faculty | 37 |
| Postdoctoral | 15 | Research Associates | 93 |
| Graduate Students | 114 | Staff | 31 |
| Undergrad Students | 81 | Total | 426 |

# Leveraging R&D in Montana

- Development of an Montana-wide supercomputer center will benefit R&D efforts in the region.
- The resources must be connected to high speed, broad-band optical networks.
- MUS research community can provide support through grant-funded opportunities - but cannot sustain the resource. Industry partners are essential.
- Staffing the center will bring new, highly skilled individuals to Montana and provide excellent training and career opportunities for MUS students and graduates.

Gwen Jacobs, Academic Computing, MSU

MONTANA STATE UNIVERSITY

# Benefits to MUS research

- Expertise at the Butte Supercomputer Center will help MUS scientists become more competitive for grant funds.
- The Butte Supercomputer Center will provide a regional computational resource for Montana and other states in the West.
- Specific research areas that will benefit:
  - Precision agriculture - GIS based models of crops and pests
  - Study of plant genomes for better crop production and disease resistance
  - Energy research - simulations of terrestrial carbon sequestration
  - Simulation of wind powered turbines for clean energy sources
  - Drug-discovery research - simulation studies
  - Disaster preparedness - infectious disease outbreaks, earthquakes
  - Weather prediction
  - Fire simulations

MONTANA STATE UNIVERSITY